INDUSTRIAL UTILIZATION OF SOUTHERN AGRICULTURAL COMMODITIES

by D. F. J. Lynch, Director 1/
Southern Regional Research Laboratory
New Orleans, Louisiana
Bureau of Agricultural and Industrial Chemistry
Agricultural Research Administration
U. S. Department of Agriculture

Large-scale industrial utilization of agricultural products has been the dream of many people interested in agriculture, for several decades. This interest has been intensified during periods of burdensome surpluses, and as you all know we have had recurring burdensome surpluses within the past 15 years in some of our basic crops:- such as cotton. These conditions have carried this interest to a point where formal and organized action is now being taken to increase the industrial utilization of agricultural products. The Federal Government, several State Governments, and several private and semiprivate organizations are now actively engaged in various research programs in this comparatively new field.

Some of these organizations are conducting fundamental and applied research on the growing of agricultural commodities for industrial uses; some are doing analagous work in the field of utilization; and some are carrying on promotional work to educate consumers and attract capital to manufacturing possibilities. Each type of activity has its place, each is necessary, and, for maximum progress, considerable cooperation should be maintained among all these groups.

I am not going to paint a rose-colored picture of the chance for quick large-scale increases in the industrial utilization of agricultural products. The progress that has been made in the past along these lines has been slow. The reason for this is that progress is largely dependent upon research and development which are careful, painstaking, and time-consuming. It is not a case, for example, of discovering that sweetpotatoes contain starch and then setting up plants to extract the starch. That sweetpotatoes contain starch has been known for a long time. The real problem is to grow a particular variety of sweetpotato, having a high starch content, at a certain allowable, maximum cost per ton, and to develop methods for extracting from these sweetpotatoes a high-grade starch with particular properties for specific uses, all at a cost which will insure a commercial market for the starch at a price that will enable the farmer-producer to make a profit. There is also the alternate - the development of other salable by-products from the sweetpotato (in addition to the starch) to carry some of the expense and thus solve the problem and insure the success of the venture.

Although progress and developmental work of this nature is slow, there have been enough successes in efforts of this nature to prevent anyone from being too pessimistic. One of the most recent successful examples is the industrial utilization of soybeans in this country. I think we can expect a greater rate of progress, affecting a wider range of commodities, in the future. This will naturally follow from the increased emphasis which is now being placed on this

1/ Presented before the Annual Meeting of the Southern Association of Science and Industry, Birmingham, Alabama, April 23, 1943.

type of research, and from the fact that the cumulative knowledge thereby obtained will multiply research effectiveness in dealing with agricultural commodities as raw materials for industrial uses.

The growing of agricultural commodities specifically for industrial utilization is in most instances a major problem. In the past, or for that matter even today, agronomic and genetic research has centered mainly on producing products with properties best suited for food and animal feeds. Those parts of the crops utilized industrially have usually been the culls, such as cull peanuts for oil, and cull white potatoes for starch. But no large-scale industry can develop unless it can be assured of its raw material. In the first place, the availability of culls vary with the food and feed demands, and are extremely variable from year to year. This makes plant operation spasmodic and capital investment unsafe.

In the case of some commodities, therefore, we think agronomic and genetic research should be directed also to industrial utilization as the specific objective. The growing of sweetpotatoes for starch, mentioned a moment ago, offers a good example. In the southern states, the average yield of sweetpotatoes for food is less than 100 bushels per acre, whereas for starch the yields are running from 180 to 200 bushels per acre and in small-plot tests, even these yields have been doubled. In the first market uniform size and flavor are of paramount importance, while in the second case maximum starch-per-acre, regardless of size, but of a type of potato which lends itself readily to starch extraction are the main considerations. Not all the sweetpotatoes a farmer raises can be sold on the food market. Grading is necessary and this step is apt to be rather expensive. On the other hand, the starch plant buys field-run potatoes by weight. I mention these growing problems as, in the future, few of us here may be directly interested in the growing of agricultural commodities for industrial utilization.

When considering industrial utilization of agricultural commodities, we must keep our feet on the ground. Our emotional interest is stirred when we are shown samples of beautiful plastics and other products made from common agricultural commodities, but we must not lose sight of the fact that there is usually a big gap between physical possibility and commercial feasibility.

After the producer has assured industry a supply of raw material the technologist must take this material and manufacture a salable final commercial product. Here are involved the technical and economic problems of processing, which are based on fundamental research and studies of particular properties required for specific uses.

In comparison with mineral products as raw materials for industrial uses, agricultural commodities have both advantages and disadvantages. Agricultural products are in general more variable in quality, and their prices fluctuate through a wider range. For efficient utilization of processing plant equipment, these commodities also require storage over a large portion of the year. On the other hand, once a demand is established, the supply is renewable annually as compared with a gradual exhaustion of mineral supplies with increasing costs.

More important than these considerations, however, are the reasons why we should attempt to develop industrial uses for farm commodities. Probably the most important, is the simple fact that, in normal times, our farms are overpopulated from the standpoint of how many people are required to produce what we need and can export in the way of food, feed, and fiber crops. The demands of a people for food, clothing, and shelter vary little with changes in price.

Therefore, when the prices of our agricultural commodities drop there is developed no great increase in demand for these products and for this reason we experience large fluctuations in the price of these commodities. On the other hand the demand for industrial products responds quickly to changes in price. This results in smaller fluctuations in price of these raw materials. The industrial utilization, therefore, of even a small part of a crop would have a marked stabilizing effect on its price. And I am sure that you all will agree that such a condition would be most desirable. Since our standard of living is dependent upon our per capita production of wealth (that is, useful goods and services) it is to the best interests of all to develop means for increasing the production of useful farm commodities. The development of industrial outlets for agricultural commodities will we think provide these opportunities.

We know from the chemical composition and physical properties of almost any agricultural commodity, that in a laboratory, we can make them into an almost endless number of physically satisfactory products. The big problem is to discover methods and to design equipment and machinery for doing these same things on a commercial scale at a certain maximum allowable cost. Research of this nature is slow and costly. Blind alleys leading from initial ideas are the rule in research rather than the exception, requiring a re-orientation of ideas and a change of attack before success is reached. Concentrated research in this field is comparatively new, but, if we can reason by analogy with what research has accomplished in other fields, we can look forward to worthwhile progress in research in the industrial utilization of agricultural products. And by worthwhile progress I mean progress on a dollar-and-cents basis.

The foregoing observations apply to the industrial utilization of any agricultural commodity generally no matter where it is produced. Here in the South, we are particularly interested naturally in those commodities which are, or can be, produced for this purpose in this region. There are now in existence several research laboratories in various parts of the South. Some of these are operated as part of University research programs, some by State Governments, some by private organizations, and by the Federal Government. As many of you may know, the Southern Regional Research Laboratory in New Orleans, with which I am connected, is a Federal research laboratory operated by the Bureau of Agricultural and Industrial Chemistry of the Agricultural Research Administration, U. S. Department of Agriculture, for the purpose of increasing the industrial utilization of southern agricultural commodities.

In order to show you that we are well equipped to cope with these huge problems, I ask your indulgence while I give you a very brief picture of our organization.

Our physical plant is composed of a four story U-shaped main building and an associated power plant. The main building is 212 feet along the front or base of the U, and 368 feet along the sides. One wing is equipped with 72 laboratories while the other wing is designed to house our pilot plant equipment. The federal government has about $1,500,000 invested in these buildings. This amount does not include fixed laboratory equipment which is worth over $200,000. Inside our pilot plant there has been erected a small textile mill 95 feet long by 65 feet wide. This mill occupies three floors and is completely air-conditioned with an individual air-conditioning unit for each floor so that the temperature and humidity can be varied in one room without affecting any other section of the mill. The degree of control for both temperature and humidity is greater than in that of the best air-conditioned offices. To ensure such a high degree of atmospheric control is expensive and this mill was erected at a cost of $95,000.

Our purpose in this construction was to make possible the exact reproducibility of results and their application in the cotton textile industry. Besides being able to reproduce results of experimental runs, we desire to be able to make runs under various control conditions representing the climate prevailing in particular localities throughout the country. This experimental mill includes modern standard textile machinery for all steps in the manufacture of cotton fabrics from opening through weaving, and the necessary auxiliary equipment such as that for winding and warping. Connected with the mill we have a modern testing laboratory equipped with the machines for making a wide variety of physical tests on textiles. In this mill we have installed over $75,000 worth of textile machinery. At our laboratory we have a very well trained staff of chemists, physicists, bacteriologists, biochemists, chemical engineers, mechanical engineers, and cotton technologists, totalling over 175. We are very proud of our Southern Regional Research Laboratory and I wish to extend to you all an invitation to visit it when you get to New Orleans. I also want to assure you that we are appreciative of research suggestions within the scope of our authority.

When plans were made for our research program, the southern agricultural commodities cotton, sweetpotatoes, and peanuts were selected for initial attention: cotton, mainly because of acute surplus problems, and peanuts and sweetpotatoes primarily because they seemed to be the products of this region most likely adaptable to industrial utilization. It was realized that there are other farm commodities which also offer opportunities for industrial utilization, but we also realized that if we spread our efforts out over too broad a field the effectiveness of the entire program would be reduced.

In regard to our research today all of us here realize that for the "duration," war needs control the objectives of research as well as all other efforts of the nation. Even before December 7, 1941, a large portion of the research program of the Southern Laboratory was on problems relating to National Defense. At that time the program was revised to concentrate all our research effort upon problems directly connected with the nation's war effort. Short time special projects to aid the war effort were given precedence over all others. For the most part this research deals with the development of products to replace or supplement others made from imported commodities, or from scarce domestic commodities. Much of this work was undertaken at the request of the War Department, the Navy Department, and other war agencies.

In this category, there are a few projects which can be mentioned openly and which I think you will be interested in. One of our oldest projects is the suitable rot-proofing treatment for extending the life of sandbags, especially cotton sandbags. This work was undertaken at the request of the Corps of Engineers, War Department. We are testing all the commercial materials acceptable to the Engineers Corps as well as developing new and more effective preservative treatments and more satisfactory testing methods. One group of our scientists is working on the development of suitable cotton binder twine to supplement supplies of imported sisal and henequen for this binder twine. This material is badly needed on our farms. We are also developing special treatments for cotton yarns which gives them wet-swelling properties similar to those of linen to supplement or take the place of linen in the manufacture of fire hose. In cooperation with the Birmingham unit of a large manufacturer of tin- and terneplate, we have developed a "tailormade" cottonseed oil to replace palm oil. This modified cottonseed oil has been found to be more stable for this use, and although it costs twice as much as the commercial palm oil it has three times as long a life. We are also developing a "tailormade" peanut oil to be used as a textile lubricant. Preliminary reports from a large textile manufacturer state

that this modified peanut oil is superior to all oils available at this time and has some very important properties superior to the highest type of olive oil used for this purpose during peacetime. This "tailormade" peanut oil can be manufactured at a lower price than the peacetime price of this type of olive oil. Although these projects are of a wartime nature, they show promise in the utilization of agricultural commodities during our post-war period. Of a purely wartime nature, we have developed a new type of cotton cutter for the manufacture of ordinary lint cotton into chemical cotton, to supplement our short supply of linters in the manufacture of smokeless powder. Our small experimental cutter handles more than a ton of cotton per hour and a full size machine which is now being constructed is expected to handle 8 to 10 tons of cotton per hour. In cooperation with commercial cotton cord manufacturers in Georgia, and a tire manufacturer in Mississippi, we are conducting intensive research on the development of a cotton tire cord which we hope will be equal to rayon for army vehicles in wartime service. This project also should affect our use of cotton in this field during our post-war period.

After the war we will have to face competition from the newer synthetic fibers such as nylon and vinyon, as well as from rayon. Also, we can expect foreign countries to increase their production of a type of cotton which will be highly competitive with American cotton. We will probably have to rely to a greater extent on the domestic markets for American cotton. Do not let me give you the impression, however, that the situation facing the southern cotton industry is hopeless. With more real research being done on cotton products and the processing of cotton, and with sound educational and promotional programs, such as those conducted by the Cotton Textile Institute, the National Cotton Council, and others, the future really looks brighter than it did five, four, or even three years ago. Without any reflection on the textile industry, (for they are the first to admit it) we are just beginning to learn how to use cotton intelligently as a raw material. We are learning something about the real importance of the elasticity of the cotton fiber and about what causes deterioration from sunlight, laundering, heat, and other conditions to which cotton fabrics are normally subjected. Cotton products of the future will be better products, they will be more uniform in performance and, I hazard the prediction, cheaper.

Returning to the general theme of this discussion, let me summarize our views regarding the future of post-war industrial utilization of southern agricultural commodities, with the observation that I believe these views are shared by most of the people working in this field:

1. Increased utilization of agricultural commodities is a worthwhile goal.

2. Research will be the basis of progress towards this goal.

3. Progress will not be quick and spectacular but will be sound.

Our real research job is to obtain results which will provide increased industrial outlets for crops grown on our large southern acreage and thus help utilize the large industrial plant capacity which will be available in the South at the end of this war.